



The T-carrier system originated many years ago as a technology developed by AT&T. The intended use of the scheme was to increase the voice channel capacity within their central offices. By the late '80's it became apparent that the demand from subscribers for bandwidth greater than 56K was becoming a reality. The extension of the T-carrier system into the subscriber network was a natural. The technology having already been developed, the migration to the premise was about to evolve.

As T-1 signaling began to migrate outward from the central office, it became evident that standards would be required to help maintain the integrity of the T-carrier system. ANSI accepted the chore and by the late '80's a number of ANSI T1 standards had been developed and published.

From the installer's perspective, two of these standards hold particular relevance.

***ANSI T1.403** *Carrier-to-Customer Installation - DS1 Metallic Interface*

***ANSI T1.102** *for Telecommunications – Digital Hierarchy – Electrical Interfaces*

The content of T1.102 is primarily aimed at the signal delivered from the T-carrier to the customer interface (premise demarc).

The content of T1.403 is aimed primarily at the signal and the physical layer to and from the demarc and the CPE (customer premise equipment). More specifically, only to and from the very first piece of CPE. This may be a CSU, DSU, IAD, or router. T1.403 specifically states that all wiring beyond that point (inward to the remaining CPE) should be as specified by the equipment manufacturer.

In choosing the proper cable to extend the T-line (demarc extension cable) these coordinated documents call out specific physical and electrical requirements which must be met in the installation.

These are summarized as follows:

*Balanced pairs, 22 AWG, 100 Ohm impedance.

*T-carrier to complete the demarc in RJ48 jack configurations.

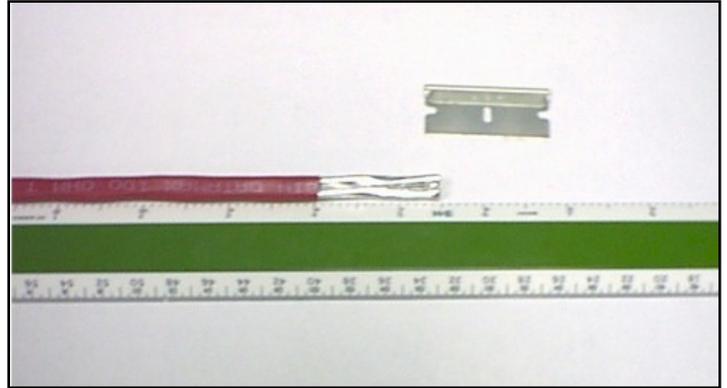
*T extension to be pinned in plugs configured in RJ48 C or X. (See below for plug pin-out.) Certain D.B. connectors are authorized but rarely used.

*Loss budget (attenuation) allotted for this cable section should be 5.5 dB. This value translates to about 1,000 feet of properly designed cable without the need for repeaters. This distance will often eliminate the need for costly demarc relocations.

Pin-Outs

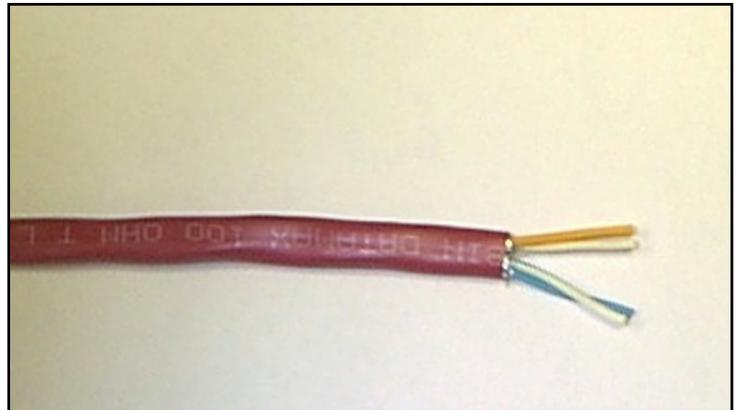
Terminating in an 8-pin modular plug is specified in ANSI T1.403. USOC RJ48 pinning is required.

Step 1 Using a safety razor blade, utility knife, or similar tool, ring the plastic outer sheath approximately 1-1/2 inches from the end. Remove the 1-1/2 inch slug from the construction. The two individually shielded pairs are now exposed. (**Note:** If the blade modestly nicked the tape and even the insulation, continue anyway. These will be removed in future steps.)



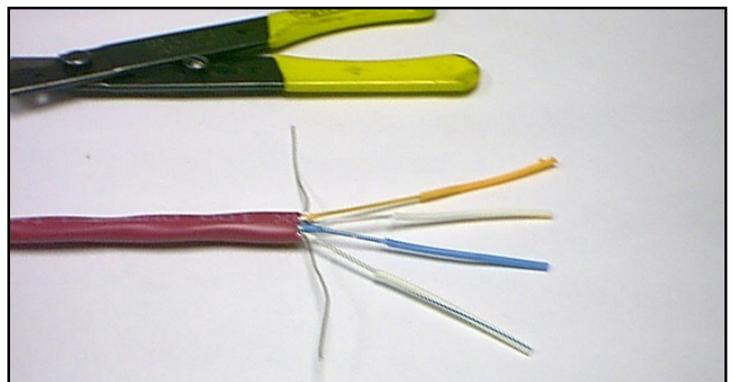
Step 2 Remove all tapes flush with the jacket line. (**Tip:** A simple nick at the lip of each tape will permit easy tearing around the film. This is a very simple process.)

You should now have a white x orange pair and a white x blue pair exposed.



Step 3 The insulation system of this construction is made up of a dual layered composite. Removing the outer layer (foam) will leave the inner insulation behind. Remove the outer insulation of all four leads leaving the inner insulation adhered to the copper wire.

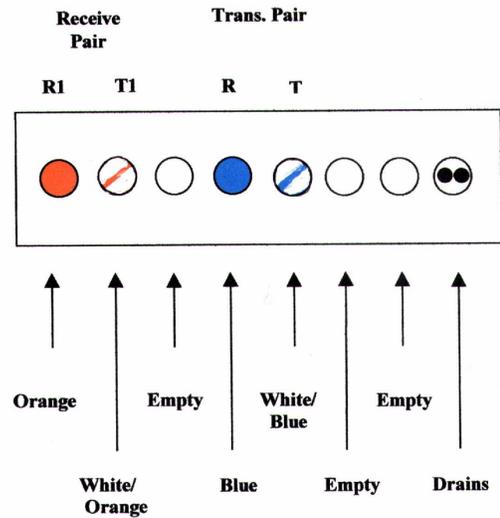
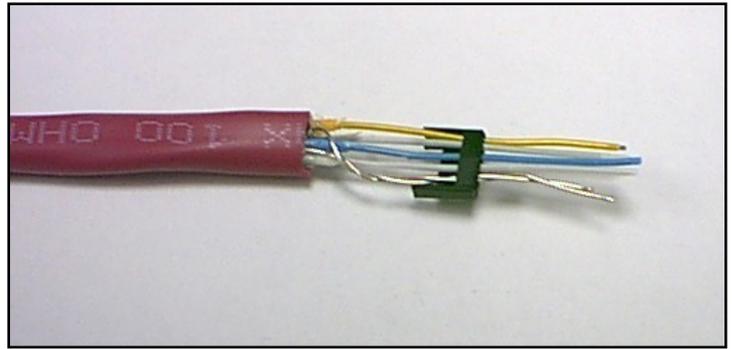
The trick is to cut the outer layer without injuring the inner layer. Inexpensive insulation strippers are best suited for this step. Preferably the design will permit a depth setting to be adjusted and locked with the tool. If the setting is by AWG, start with 18 AWG as the setting. If the tool uses a non-indexed setting, a trial and error approach may be necessary.



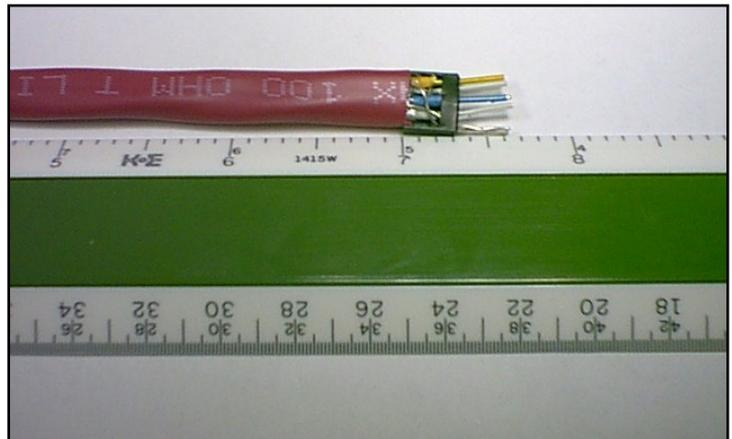
In either event, the removal process must be performed using a pull direction in a straight line with the cable's construction. If the pull direction is at an angle, the inner insulation is at risk.

Step 4 Quabbin Wire & Cable suggests the use of modular plugs that include a "load bar" (however there are plugs without a load bar that are popular connectors). This type of plug GREATLY reduces termination time, frustration, and errors. The two drains may be twisted together and inserted through the same position.

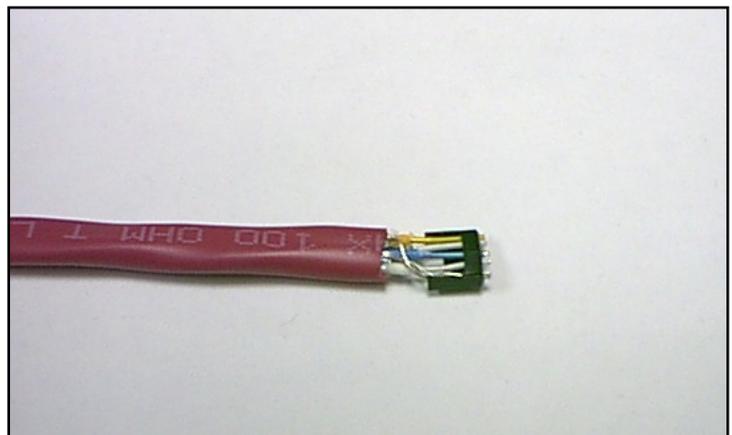
The load bar accommodates quick, precise arrangement of leads and drains prior to insertion into the plug cavity. The pin out (color code arrangement) for USOC connector RJ48C is as shown in the "load bar" figure. The jack at the demarc expects to see this arrangement.



Step 5 Slide the loaded "load bar" toward and flush with the jacket. Measuring from the jacket's edge, cut the extended leads and drains straight across and evenly leaving 5/8 inch.



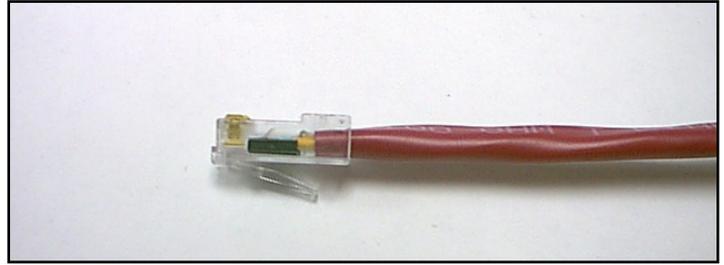
Step 6 Slip the load bar outward toward the end of the cut leads. Stop the load bar just short of the immediate end. (**Note:** The purpose of the load bar is to "aim" the leads so that they enter the plug cavity precisely positioned to pass through to the correct pin positions.)



Step 7 With the plug's release trigger positioned downward, and the orange conductor positioned left-most, press the cable with load bar into the plug cavity causing the leads to now extend to the far end of the plug nose.

When correctly positioned:

1. The conductors should extend to the end of the plug
2. The load bar should be firmly seated so as to resist further movement in either direction
3. The outer jacket should enter the plug cavity about 1/4 inch

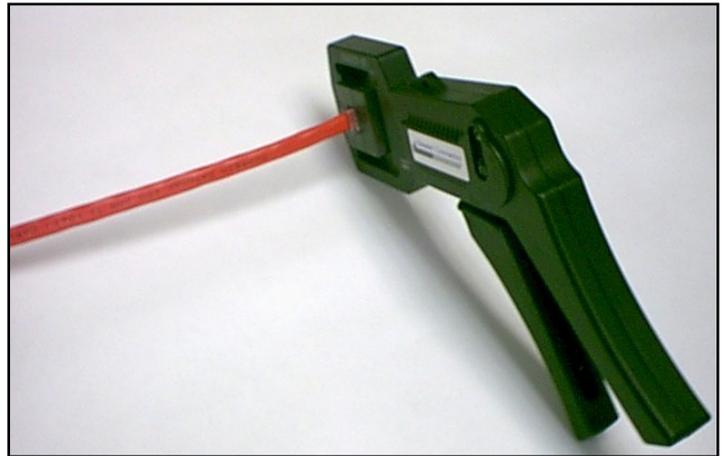


Step 8 Using a mod plug crimping tool containing an 8-pin compression die, press the assembled cable and modular connector into the die. Manually complete the mating of the cable and plug by compressing the handles through a complete cycle.

The pins should now have continuity with the conductors and the jacket should now be held in place by an included strain relief.

Remove the assembly from the crimping tool.

This terminated end is ready for installation at the demarc point.



Quabbin's Solution

Quabbin Wire & Cable has designed part number 9720 to carry this signal. It is a true T-1 demarc extension cable. Cable specification information is shown below.

Ask your preferred distributor for it by name and part number.

PN 9720

1) CONSTRUCTION:	NOM. DIA.
CONDUCTOR: 22 AWG SOLID TINNED COPPER	.025"
INSULATION: TWO LAYER COMPOSITE POLYOLEFIN .020 WALL THICKNESS	.065"
PAIRS: COLOR CODED SINGLES TWISTED WITH FILLERS INTO PAIRS WRAPPED WITH AN ALUMINUM POLYESTER FOIL SHIELD (FOIL OUT) 100% COVERAGE PER PAIR. 24 AWG SOLID TINNED COPPER DRAIN EACH PAIR.	.133"
ISOLATOR: EACH PAIR SHALL BE ELECTRICALLY ISOLATED FROM EACH OTHER WITH A POLYESTER TAPE WRAP	.136
CABLE: (2) SHIELDED PAIRS PULLED IN STRAIGHT	.136" X .272"
JACKET: POLYVINYLCHLORIDE, BEIGE, .022" NOM. WALL THICKNESS	.178" X .315"

2) PHYSICAL PROPERTIES:	
TEMPERATURE RATING, MAX.	60°C
WT./M', NOM., NET.	35.12 LBS.

3) ELECTRICAL CHARACTERISTICS:	
CAPACITANCE, MUTUAL	15 PF/FT. AT 1 MHZ
DIELECTRIC WITHSTANDING, MIN	1500V RMS
VOLTAGE RATING, MAX.	300V
NEXT, TYPICAL	GREATER THAN 60 DB; 500KHZ TO 3.5 MHZ
D.C. RESISTANCE, MAX. PER ASTM B258	16.6 OHMS/M'
IMPEDANCE, CHARACTERISTIC, NOM	100.0 OHMS FROM 500 KHZ TO 3.5 MHZ (+/- 10 OHMS AT .772 MHZ AND AT 1.544 MHZ)
RETURN LOSS, TYPICAL	GREATER THAN 30DB; 500 KHZ TO 3.5 MHZ
ATTENUATION:	

FREQUENCY MHz	ATTENUATION dB/1000 FT
0.772	5.5
1.544	7.7
3.152	10.9

4) AGENCY APPROVALS:
NEC (UL) TYPE CMR
CEC C(UL) TYPE CMR

5) APPLICATION:
T1: LEVELS 1,1A AND 1C INTERCONNECTION COMPLIES WITH ANSI T1.403 CARRIER-TO-CUSTOMER INSTALLATION - DS1 METALLIC INTERFACE AT A MAXIMUM LENGTH OF 200M (655FT). RoHS COMPLIANT MATERIALS.

NOTE: THIS CONSTRUCTION IS UNIQUELY DESIGNED TO FIT MOST POPULAR RJ-45 CONNECTORS WHEN THE OUTER PRIMARY INSULATION IS REMOVED.

6) PRINT:
QUABBIN DATAMAX 100 OHM T1 (DS1) CABLE P/N 9720R -- TYPE CMR (UL) C(UL) 22 AWG SHIELDED –

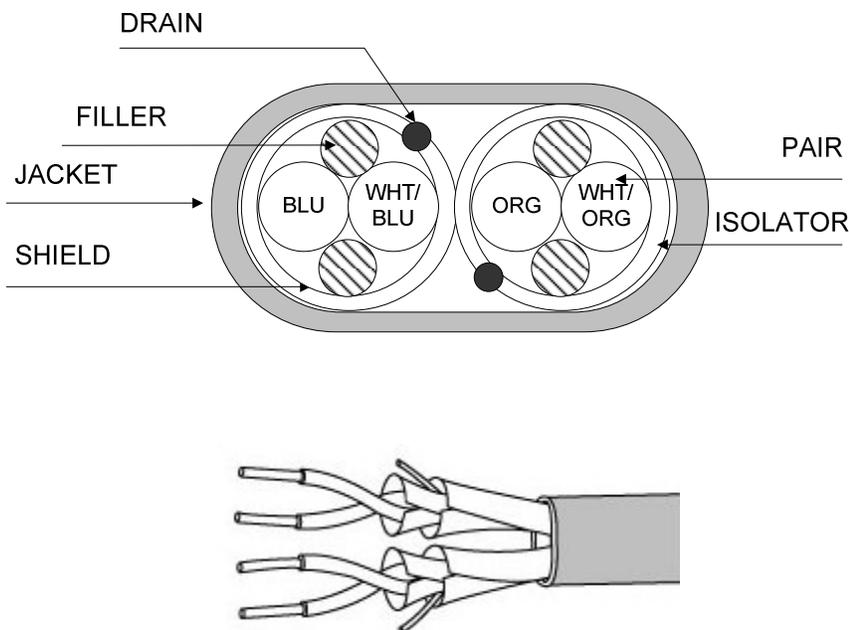
RoHS -- (LOT DESIGNATOR) (SEQUENTIAL FOOTAGE)

7) COLOR CODE:

1. ORANGE X WHITE/ORANGE
2. BLUE X WHITE/BLUE

8) PACKAGING:

TO BE PACKAGED AS PER QWC'S STANDARD PACKAGING



It is important that the termination be performed using the manufacturer's recommended crimping tools, procedures, and hardware. The following connectors are suggested. Contact the manufacturer for availability and details.

Suggested Plug Manufacturer

Connector Part Numbers

Sentinel Connector Systems*
(717.843.4240)

110-080820-24

Stewart Connector Systems
(717.235.7512)

940SP3088OB

Tyco Electronics (AMP)
(800.468.2023)

5-558530-3 00

*This particular connector system does NOT include a load bar; it is however a popular proven connector.